

Thermodynamics of Ketoreductase-Catalyzed Reactions in Non-aqueous Media

In recent years, the use of biocatalysis for organic synthesis in non-aqueous media has become an attractive alternative to traditional chemical synthetic methods. The most notable examples involve lipase-catalyzed reactions which are widely used for the stereoselective resolution of racemic mixtures. Of increasing use and interest are the ketoreductase-catalyzed reductions of carbonyl groups.

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The reactions described here are being used for the synthesis of chiral secondary alcohols, which are extremely useful intermediates for pharmaceuticals, agrochemicals, and liquid crystals. For these reasons, we have carried out thermodynamic studies (equilibrium constants and molar enthalpies of reaction) of representative ketoreductase-catalyzed reactions which have included 2-alkanones, cycloalkanones, and 1-phenyl-1-alkanones. These reactions were carried out both in organic solvents and in supercritical carbon dioxide (SCCO₂). SCCO₂ has a very significant advantage in that the solvent is easily removed by opening the reaction vessel to the atmosphere.

The thermodynamic results obtained in these studies are essential both for the basic understanding of the energetics of these reactions and for the practical utilization (process optimization and heat-balance calculations) of these reactions.

Publications

Tewari, Y.B., M.M. Schantz, K.W. Phinney, and J.D. Rozzell, "A thermodynamic study of the ketoreductase-catalyzed reduction of 2-alkanones in non-aqueous solvents." *J. Chem. Thermodyn.* 37, 89-96, 2005.

Tewari, Y.B., K.W. Phinney, and Joel F. Liebman, "A thermodynamic study of the ketoreductase-catalyzed reactions. 2. Reduction of cycloalkanones in non-aqueous solvents." *J. Chem. Thermodyn.* (in press).

Tewari, Y.B., N. Kishore, J. D. Rozzell, D. J. Vanderah, and M.M. Schantz, "A thermodynamic study of ketoreductase-catalyzed reactions. 3. Reduction of 1-phenyl-1-alkanones in non-aqueous solvents." *J. Chem. Thermodyn.* (in press).

